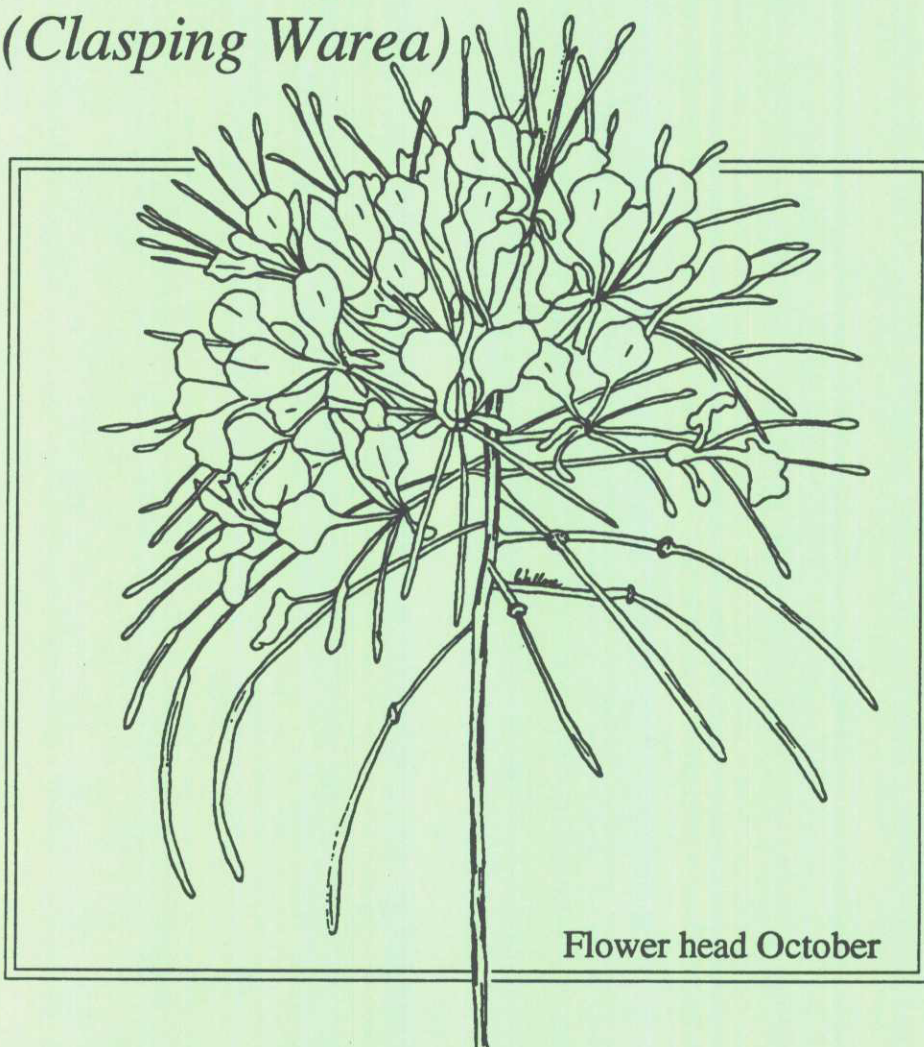


# RECOVERY PLAN

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## Warea amplexifolia (Clasping Warea)



U.S. Fish and Wildlife Service



# *Warea amplexifolia*

## Clasping Warea

## Recovery Plan

Prepared by

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for

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U.S. Fish and Wildlife Service  
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Approved: \_\_\_\_\_

*James W. Pulliam, Jr.*  
James W. Pulliam, Jr., Regional Director  
U.S. Fish and Wildlife Service

Date: \_\_\_\_\_

February 17, 1993

## DISCLAIMER

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies involved in formulating the plan, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director as **approved**. Approved plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

## LITERATURE CITATION

The literature citation should read as follows:

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Atlanta, Georgia. 15 pp.

Additional copies of this plan may be purchased from:

Fish and Wildlife Reference Service  
5430 Grosvenor Lane, Suite 110  
Bethesda, Maryland 20814

Telephone: 301/492-6403 or 1-800/582-3421

The fee for the plan depends on the number of pages.

## EXECUTIVE SUMMARY

**Current Species Status:** Clasping Warea (*Warea amplexifolia*) was listed as an endangered species in 1987. Ten populations are known to exist, all in central Florida. In a 1991 survey of this annual species, only one known population had more than 1,000 plants; four had 50 or fewer. Four sites have enough acreage and *Warea* plants to make them suitable for long-term management. The prospects for arranging long-term protection and management of these sites are uncertain.

**Habitat requirements and Limiting Factors:** *Warea amplexifolia* apparently has always been restricted to high pineland (or sandhills) vegetation. Nearly all such habitat was destroyed for citrus groves, and the small remnants are under development pressure. As a result, this species is likely to become extinct in the next decade without concerted conservation efforts. Recreating high pineland from abandoned citrus groves appears impossible, but degraded high pineland may be restorable.

**Recovery Objective:** Protection of existing populations for the foreseeable future; to create new populations if feasible.

**Recovery Criteria:** Reclassification to threatened can be considered if 10 geographically distinct, self-sustaining populations are protected and managed; delisting could be considered when 20 such populations have each been monitored for at least 8 seasons.

### Actions Needed:

1. Inventory, map, and monitor known populations; search for more populations.
2. Protect habitat by assisting landowners or by purchasing it.
3. Conduct research needed to develop methods and find locations for establishing new populations.
4. If feasible, establish new populations and start long-term monitoring of results.

### Estimated cost of recovery:

Year	Need 1	Need 1a <sup>1</sup>	Need 2	Need 3 <sup>2</sup>	Need <sup>2</sup> 4
1993	7,000	0	3,000	3,000	2,000
1994	9,000	0	6,000	4,000	2,000
1995	8,500	100,000	5,000	3,000	4,000
1996	4,000	100,000	4,000	2,000	9,000
1997	3,500	120,000	2,000	1,500	5,000
Total	32,000	320,000	20,000	13,500	22,000

<sup>1</sup> This is an estimate of the cost of purchasing about 80 acres of habitat (at \$4,000/acre). Any land acquisition costs to be borne by the Fish and Wildlife Service will be budgeted through the Service's land acquisition process, not in the recovery plan.

<sup>2</sup> Further monitoring (until at least 2005) will require about \$2,000/year. Establishment of more populations will require additional expenditures.

**Date of Recovery:** If recovery proves practicable (ie., if habitat is conserved and if establishing new populations proves feasible), downlisting to threatened could be possible in 10 years, delisting as soon as new populations have been monitored for at least 8 years. This would mean monitoring costs of at least \$10,000 for the years 1998-2003.

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## PART I. INTRODUCTION

### A. INTRODUCTORY INFORMATION

#### Description and Taxonomy

Clasping Warea (*Warea amplexifolia*) was listed as endangered on April 29, 1987 (52 FR 15501). It is an annual species of the mustard family (Brassicaceae or Cruciferae) which is distinguished by its heart-shaped, clasping leaf bases and its pale green, slightly glaucous leaves. No other plant within its range has these characteristics and the species can be readily identified even without flowers.

Plants may be 30 to 100 centimeters tall and the stalk may be unbranched or (more often) begin branching mid way up the stem. Leaves are alternate, from 2 to 5 centimeters long and 1 to 3 centimeters wide, smaller as they ascend the stalk, with a rounded apex and entire margin. On young plants the leaves are slightly folded along the midrib, tipped upward, and the lobes at the base of the leaves reach around the stem. The leaves are slightly fleshy and, even though they are much thinner, they are reminiscent of cabbage leaves in texture and sheen.

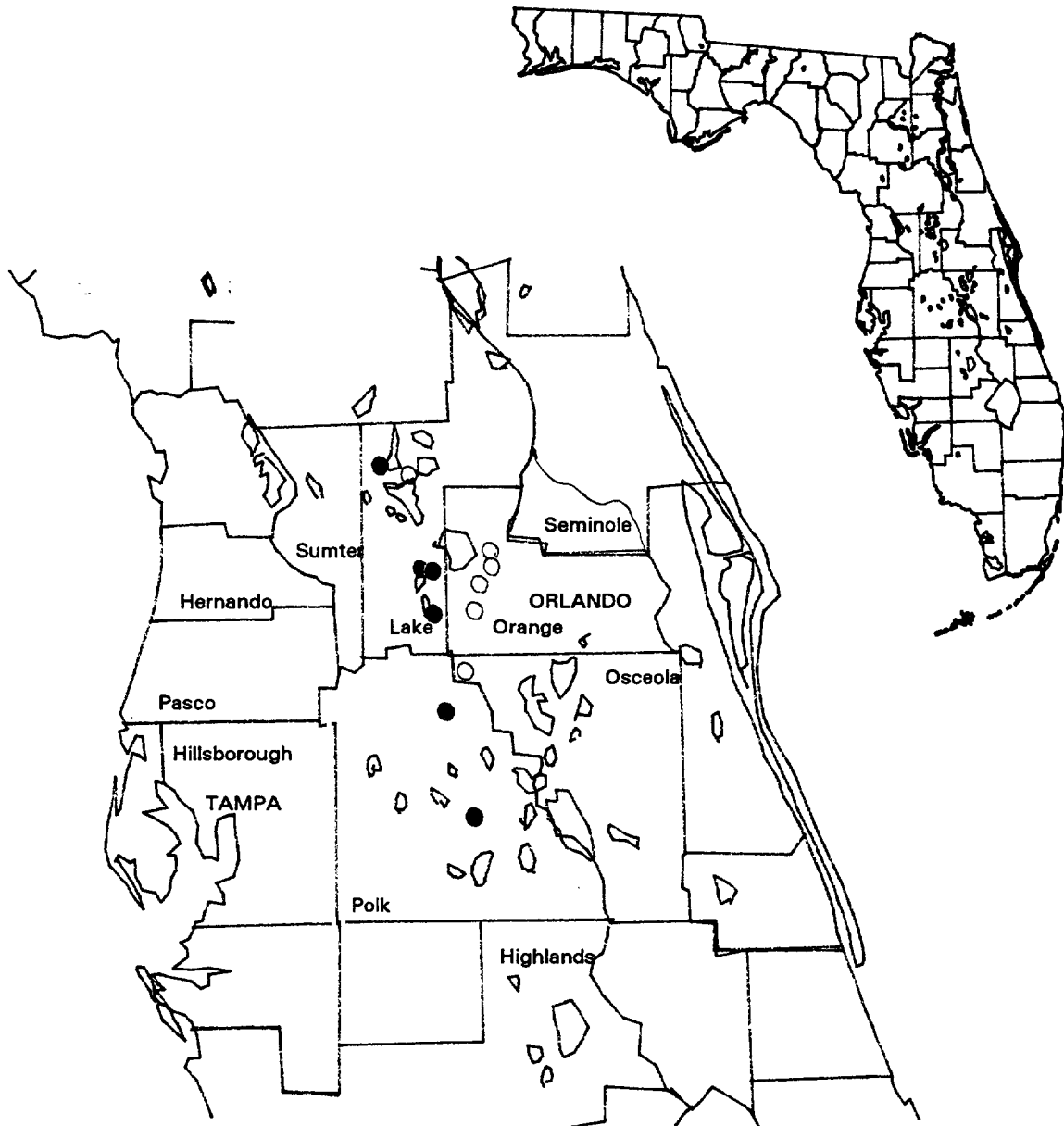
The three other species in the genus are also found in Florida: wedge-leaf warea (*Warea cuneifolia*) and sessile-leaf warea (*W. sessilifolia*) in the Panhandle, and Carter's Warea (*W. carteri*), mostly in Highlands County, whose range slightly overlaps that of *W. amplexifolia* in Polk County. *Warea carteri* can be readily distinguished from *W. amplexifolia* by its longer, slightly reddish leaves, tapered leaf bases, and white flowers.

The pale lavender flowers of *W. amplexifolia* (which vary among individuals from almost white to almost purple) appear at the ends of the branches in spherical clusters (actually flattened racemes) about 5 to 6 centimeters across. Superficially, the flowers look like small versions of the common garden cleome (*Cleome hasslerana*), a member of the family Capparaceae. Walter Judd (1980) speculates that *Warea* may be an evolutionary link between the two families. The inflorescences are dainty, and the effect in the field, en masse, is almost fluffy. Individual flowers are about 1.5 centimeters across, with four petals and six long stamens.

The plant is also readily identifiable in seed, even as the stalk turns brown and the leaves wither, by the clusters of narrow, downward-curving seed pods, from 5 to 7 centimeters long. The pods split longitudinally with small black seeds on either side of the center membrane.

*Polanisia tenuifolia*, an annual member of the Capparaceae which grows about as tall as *Warea*, is often found blooming with it and might be mistaken for *Warea* when the plants are brown and dry at the end of the season. However, *Polanisia* seed pods which are about the same size, appear singly in the leaf axils and are upward pointing.

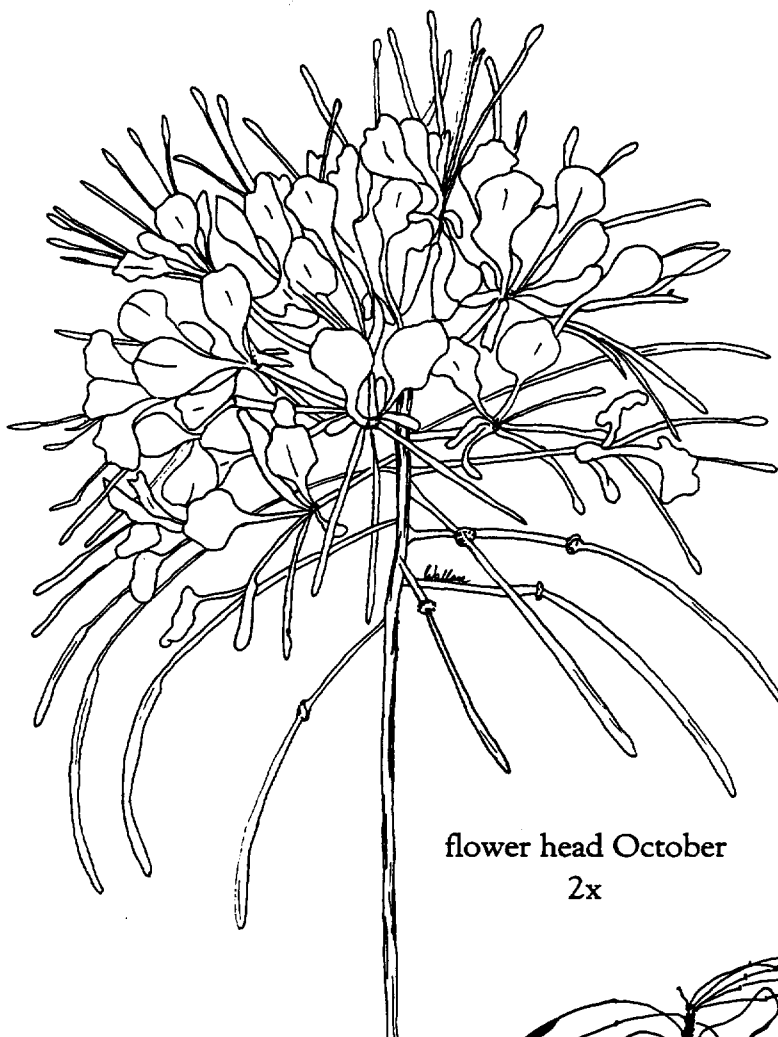
## Distribution of *Warea amplexifolia*



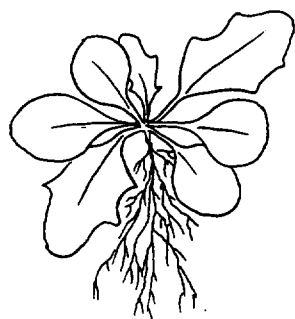
- Black dots: present (or very recent) distribution in Lake County (near Lake Griffin, Clermont and south of Clermont) and Polk County (north of Haines City and near Lake Wales).
- Open dots: older herbarium specimens, Orange and Lake Counties (western Orlando metro area including Apopka, Clarcona, Ocoee, Windermere (Orange Co.), Tavares (Lake Co.), and Wilson Lake Road (Osceola Co.))



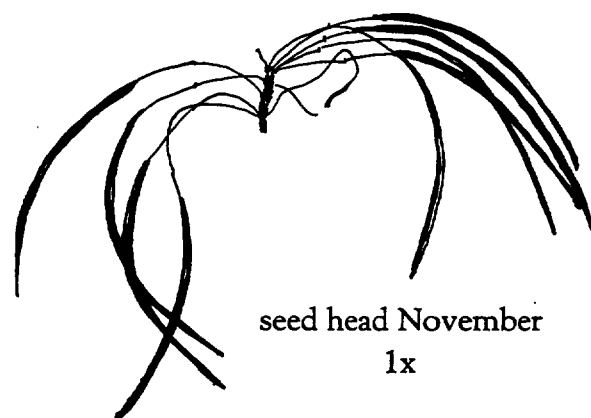
seedling April  
1x



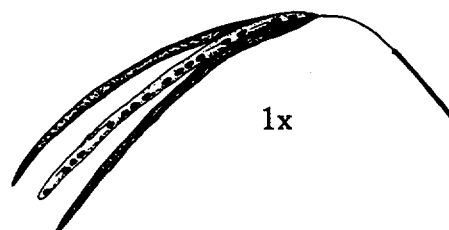
flower head October  
2x



seedling February  
1.5x



seed head November  
1x



1x

*Warea amplexifolia*



## Habitat and Distribution

*Warea amplexifolia* is native to the longleaf pine/wiregrass areas which once covered the Lake Wales Ridge in Lake and Polk counties, central Florida. This sandhill or high pine (Myers 1990) ecosystem is a biologically rich environment which is maintained by fire, most often patchy summer fires sparked by lightning. There is evidence that *Warea* will persist for a time in these areas even after the habitat is degraded, but there is no evidence that the species will migrate into other habitats. It is no longer possible to determine the actual historical range because so much of the natural vegetation along and around the Lake Wales Ridge has been destroyed. The entire range now is only 50 miles long.

The known sites mentioned in the listing package and other likely sites in Lake County were explored by several people in the fall of 1991 (Chicardi, 1991). This updated information has been recorded with the Florida Natural Areas Inventory. Because *Warea amplexifolia* is an annual species in which all the individual plants die at the end of each year, it is difficult to assess the size and vigor of a population from one year to the next. The tenuous and uncertain demography of annual species, particularly those which exist only in small populations, must be clearly understood in efforts to preserve them.

Three of the historically known populations have been extirpated. Of the 10 populations now recorded, only one had more than 1,000 plants. Four populations had 50 or fewer individuals. Only two populations are on protected land: at Bok Tower Gardens a moderate population grows in the natural area which is being maintained with a documented fire management plan, and at Lake Griffin State Park a small population persists on a parcel of land which is separate from the main part of the park and is rapidly succeeding to xeric oaks.

Four of the sites have enough acreage and large enough populations to make them appropriate for long term protection and management. As with many of the high ground areas along the Lake Wales Ridge, each of these sites also contains other rare species, both plant and animal, which are valuable components of Florida's rich biological heritage.

## Life History

Seedlings appear as tiny rosettes as early as mid-January. In cultivation these rosettes may reach 8 centimeters across, but in the field they are seldom more than 2 centimeters before the stem elongates. Leaves in the rosette stage may have a tooth on each side—a characteristic which persists in *W. carteri* but disappears in older *W. amplexifolia* leaves. New seedlings have not been observed after the end of February, although whether the seeds will continue to germinate through the spring needs to be investigated further. By April, seedlings may be more than 10 centimeters tall and readily identifiable, but the major part of the growth

occurs during the summer rainy season. Flower buds are apparent in August, flowers begin opening in September, and seed is ripe from mid-October to mid-November. By December the thin brown skeletons of these annual plants are difficult to find. The flowering schedule may shift as much as 3 weeks from one year to the next. (*W. carteri* blooms several weeks later, peaking in October, with seed ripe in December.)

Within a population, individual plant size varies from robust, multi-branched specimens 1 meter tall to a single flower cluster on a single stalk only 30 centimeters tall. Whether the smaller plants are later seedlings or genetically weaker individuals is not known. The role of competition is not clear, since large *Wareas* may be found among clumps of grasses and other vegetation. This same variation occurs in *W. carteri*, but with more of the robust multi-flowering individuals. The largest *W. carteri* is larger than the largest *W. amplexifolia*.

Population size varies from year to year for reasons not clearly understood. Anecdotal evidence suggests that rainfall in December may determine seed germination. Preliminary data from research at Bok Tower Gardens seem to indicate that even when a dry December is followed by relatively high rainfall in the early spring, population levels will be low. There is other anecdotal evidence that *Warea* seed may be banked in the soil for several years. Nancy Bissett of The Natives Nursery in Davenport, Florida, found a *W. carteri* population on a site where it had not been seen for 5 years previously. For a fall-blooming annual to have evolved in a habitat which normally burns during the summer growing season also suggests a seed banking ability. More research is required in this area.

### Research to Date

Bok Tower Gardens' Endangered Plant Program began work on this species in 1986. Although a naturally-occurring population grows, fortuitously, at the Gardens, the intent of the Program originally was to increase plant numbers and seed production by growing the plants in cultivation. The results to date in cultivation have yielded more questions than answers and—so far—no net increase in numbers.

Early attempts to grow the plants with standard horticultural techniques resulted in high seed germination and good seedling survival, yet no plants lived through the summer to reproductive maturity. Seeds were broadcast in flats of a commercial soilless mix (Metro Mix 500). When seedling rosettes were 1.5 to 2 centimeters across they were pricked into commercial bedding plant cell paks and grown until they were 5 to 6 centimeters across. (The rosettes never grow this large in nature before the stem elongates. The response in cultivation may have been caused by higher fertility in the growing medium and/or lower, more diffused light levels in the greenhouse.) At this point the remarkably healthy-looking seedlings were planted outside in natural yellow sand, and irrigated as needed to establish them. By the end of the summer all the plants had died from leaf miner, lepidopteran larvae, fungus, and unknown causes (Wallace, 1990).

Direct seeding into plots in the Gardens' natural area was attempted to simulate more natural growing conditions. About 2,000 seeds sown in November, 1989, yielded 600 seedlings; 16 plants lived to flower and set seed. Two more plots were sown with about 10,000 seeds each in November, 1990. A total of four seedlings were found, two of which lived to flower. No plants appeared the second year in the 1989 plot. We speculate that a dry December in 1990 may have been the determining factor in the low germination. A fourth plot was sown with 10,000 seeds in November, 1991. This plot, and one of the 1990 plots, were irrigated in December 1991. If viable seed can persist in the soil for several years, it is possible that more will germinate subsequently.

The seeding site was selected in an area of moderate wiregrass cover where *Warea* had never been seen before. The site had been burned in the fall of 1989. Seed was mixed with dry sand to facilitate even sowing and scattered over the 29 square-meter plots. About half the area within the plots was bare sand; seed also fell in vegetated areas. Most seedlings in the 1989 plot appeared in clusters along the thin detrital windrows formed by hard rains on bare sand. The four seedlings in the 1990 plots were solitary and came up in bare sand areas. On natural sites mature *Warea* plants can be found among thick vegetative clumps. It is not clear how important bare sand areas are to seed germination and survival.

Other field observations give a few insights into how this species behaves and suggest points which need further research. *Warea amplexifolia*'s association with wiregrass is evident, even on degraded sites. One population grows on a site where the longleaf pine was removed years ago but a dense stand of wiregrass remains. In an immediately adjacent area the wiregrass was destroyed by plowing—old furrows are detectable even though other vegetation has regrown. No *Warea amplexifolia* has seeded into this area. The nature of the relationship between *Warea* and wiregrass, if there is any, is unknown, and it is not known whether *Warea* will grow in the absence of wiregrass.

Another site where *Warea* has been recorded, but where it has not been seen in 4 years, shows dark burn scars on the trees. The site is otherwise a healthy sandhill environment with Scrub Plum (*Prunus geniculata*) and Bear Grass (*Nolina brittoniana*). Possibly an ill-timed fire, too hot a fire, or two successive fires might have destroyed the *Warea*. The fire management of *Warea* sites needs careful consideration.

Several *Warea* sites are now degraded by the invasion of one or both exotic lawn grasses, *Paspalum notatum* (Bahia grass) and *Eremochloa ophiuroides* (Centipede grass). Neither grass species is killed by fire. These grasses may pose a serious threat by covering the soil surface too densely to permit *Warea* seedlings to grow. It is not clear how to control the grasses without harming desirable species.

On the Lake Griffin State Park site the *Warea* plants persist in two small clearings on land which is overgrown with xeric oaks. Even these clearings are becoming shady and most of the plants appear small and spindly. Sunlight is obviously a factor in the vigor of this species, but it is not clear what accounts for the range of plant sizes in open grown populations.

## **B. THREATS**

**Habitat destruction** is clearly the primary threat to this species. The extent of this destruction is immediately apparent when traveling along U.S. Highway 27, which runs along the crest of the Lake Wales Ridge through Lake and Polk Counties. Most of this land was converted to citrus groves after the longleaf pines were cut for timber. Where the elevation of the Ridge affords a distant view, citrus groves stretch from horizon to horizon. This monoculture is especially destructive of the native vegetation since the soil surface in the groves is kept bare with herbicides and there are no fallow fields or fence rows of native plants to serve as refuges and seed sources.

Ironically, much of the citrus acreage in the northern half of the *Warea*'s range has been destroyed by three catastrophic freezes in the last decade. Only ruderal vegetation now grows on this old grove land, much of which has not been replanted.

**Development** is destroying habitat as urban growth moves into Lake County from nearby Orange County and expands along Hwy 27. To preserve the few remaining viable *Warea amplexifolia* populations, the remaining longleaf pine forests must be protected from further degradation and loss.

**Sand mining** also threatens one Lake County population that grows on land owned by the mining company and is immediately adjacent to the digging operation.

**Fire exclusion** and lack of management will become an increasingly more serious threat even on nominally secure sites. The Lake Griffin State Park site, for instance, is succeeding rapidly into hardwoods, and several other sites are sufficiently overgrown with grasses and perennials to discourage *Warea* seedling generation.

## PART II. RECOVERY

### A. Objective and Criteria

The immediate goal of this recovery plan is to preserve *Warea amplexifolia* from extinction as naturally-reproducing wild populations on appropriate natural sites.

*Warea amplexifolia* could be considered for reclassification from endangered to threatened status when 10 geographically discrete, self-sustaining populations are protected and managed for 10 years. Delisting could be considered when 20 such populations are protected and managed, and each has been monitored for at least 8 years. Recovery will require a minimum of 10 years (until 2003), if establishment of new populations is prompt and obviously successful.

The extended monitoring of populations of *Warea amplexifolia* is essential because the species is an annual whose populations fluctuate widely from year to year. It may take years to be certain that a population is, indeed, self sustaining. Additionally, because there are not today 10 remaining populations large enough to be biologically sustainable, it is clear that new populations must be established.

### B. Outline for Recovery Actions Addressing Threats

1. **Protect existing populations.** Because there are so few sites remaining where *Warea amplexifolia* is thriving, it is essential that these sites be protected as the first step toward recovery. At present, these sites are the only ones where it is certain that *Warea amplexifolia* will grow. All the seed used to establish new populations must come from these existing sites.
  - 1.1 **Inventory and map known populations, monitor annually.** Many individuals have already contributed good site data to The Florida Natural Areas Inventory, which compiles ongoing information on species occurrence. However, because *Warea amplexifolia* is an annual species that is difficult to find for several months each year and because population numbers vary from year to year, the known sites must be monitored and possibly re-mapped annually. (Questions of variation in population size from year to year [task 2.5] and how it is related to rainfall [task 2.4] can be addressed only through annual monitoring).
  - 1.2 **Seek new populations.** From what we know so far it seems unlikely that *Warea amplexifolia* will seed itself onto ruderal sites, so we would not expect to find this species colonizing old grove land. The species also does not appear to have any specialized seed dispersal mechanism which would carry it far from the parent plants. However, *Warea amplexifolia* is known from degraded sites where some wiregrass remains even after the longleaf pines are gone. Because the seed may bank in the soil for

several years, it is possible that new populations may be found on roadsides or vacant land where they have not been observed before.

- 1.3 **Alert planning agencies of species occurrence.** The best, known populations of *Warea amplexifolia* occur on sites that are large enough to develop into subdivisions and thus would come under the purview of local and regional land planning agencies that are charged with protecting endangered species. Planners should be made aware of *Warea amplexifolia* sites and of the vital role that land use regulation could play in the preservation of *Warea amplexifolia* habitat.
- 1.4 **Educate and provide technical assistance to planning agencies and landowners.** Written materials, responses to inquiries, and visits by knowledgeable persons should be provided to anyone in a position to preserve this species. Identification of the species on the site, appropriate management techniques, and minimum area to support viable populations are important technical points. Planners and landowners must understand that digging up individual plants and moving them to another site is not an appropriate mitigation strategy.
- 1.5 **Acquire land and otherwise obtain protected status and management funding for sites.** *Warea amplexifolia* will ultimately be preserved only through the long-term protection and management of sites where it now grows or will be established.

## 2. Research.

- 2.1 **Determine appropriate management techniques to preserve and enhance populations.** Quite a bit is already known about the management of longleaf pine/wiregrass communities, but it is important to learn how these general management strategies will affect *Warea amplexifolia* specifically. *Warea amplexifolia* occurs only on sites that historically had frequent fires. Although *Warea* persists on unmanaged, and apparently long-unburned, sites, management of these sites will require prescribed burning.
  - 2.1.1 **Determine suitable timing and frequency for prescribed burns.** While fire ecologists generally advocate summer burns to promote maximum species diversity, this may not be appropriate for a summer-growing, fall-blooming annual species. A summer burn could destroy an entire generation of plants. However, if *Warea* seeds have banked sufficiently in the soil, a summer burn may stimulate germination the following winter. The effect of rainfall must also be considered. Even when a fire stimulates seedling generation, a fire followed by a drought could cause a net

population decline. There is no information on how frequently prescribed burns should be applied.

**2.1.2 Determine whether *Warea amplexifolia* conservation is compatible with pulpwood or timber production.** There is little if any managed forest on the northern Lake Wales Ridge where *Warea amplexifolia* is presently known to occur. If *Warea* is found in managed forests, forestry practices should be assessed with respect to the survival of *Warea* populations.

**2.1.3 Determine whether the invasion of exotic species is affecting *Warea amplexifolia* adversely, and if so, what can be done.** *Paspalum notatum* (Bahia grass) and *Eremochloa ophiuroides* (centipede grass) appear to be especially serious problems; both are very resistant to removal by mechanical means. These two invaders are now common in many longleaf pine/wiregrass ecosystems where they are largely unaffected by fire. The threat posed by these grasses to the remaining populations of *Warea amplexifolia* may be very serious. Glyphosate herbicide will kill the grasses but could be used only when the *Warea* is completely dormant in December. Research is needed to determine how seriously the grasses affect *Warea*, and, if the effects are serious, how to control the grasses on *Warea* sites.

**2.2 Describe the attributes of thriving *Warea* sites.** To establish new *Warea amplexifolia* populations it is essential to know the biological parameters of sites where the species occurs naturally, including soil type, the amount of bare soil surface, drainage, rainfall, light and shade, and plant and soil microbe associations.

**2.3 Determine effect of rainfall amount and timing on population sizes.** It is suspected, but not clear, that rainfall determines population size in any given year. This task is to be performed in coordination with Task 1.1.

**2.4 Monitor to determine the normal range of variation in population size.** A decline in population size may be normal over short periods of time, but it may also signal serious problems. Land managers need to know what factors affect population size and what fluctuations are within normal limits. Over time it may be possible to draw some conclusions as to what constitutes a stable population and then determine the minimum acreage required to support it. If the seed banks maintained by *Warea amplexifolia* could be measured, they might provide better means of assessing the size and well-being of populations than the number of mature plants.

- 2.5 Develop methods for establishing new populations.** Based on the work done so far at Bok Tower Gardens, it appears that scattering seed on an appropriate site may be the most effective way to establish new populations, however more research needs to be done. The methods also need to be quantified, determining how many seeds scattered over how large an area are needed to establish a viable population.
- 3. Establish new populations.** Because so few natural *Warea* populations exist now that can be protected, new populations must be established to sustain this species over time.
- 3.1 Locate appropriate recipient sites.** New sites should be biologically appropriate (as determined under Section 2.2 above), legally protected, managed appropriately for the preservation of the species, and within the probable range of the species. The landowner or management agency must make a long-term commitment to the preservation of the new population.
- 3.2 Collect seed from donor populations.** Ideally the donor population should be the one geographically nearest the recipient site, but this may not always be possible. Until the dynamics of seed germination and seedling survival are understood, only a limited number of seeds may be collected from secure populations, in order not to diminish the next year's numbers. Seeds can be collected more thoroughly from doomed populations. It is likely that many thousands of seeds are needed to establish a new population and it may take several years to collect enough. Seed collecting must meet the requirements of Florida Statute 581.185, Preservation of Native Flora of Florida.
- 3.3 Introduce species to recipient site.** Use the methods determined under Section 2.5 above to establish the new populations.
- 3.4 Establish long-term monitoring and management program.** The success of new introductions cannot be assured for some years; they may require ongoing care and additional material to reach viable numbers. The landowner or management agency must be prepared to follow up on introduction efforts. The Florida Natural Areas Inventory should be notified of the location of introduced populations.



#### 4. Refine recovery goals.

4.1 **Reassess the number of sites and individuals necessary to constitute a stable, secure, and self-sustaining species.** Recovery goals will be revised as necessary. The population biology of this annual may prove more recalcitrant to conservation management than we anticipate and it may be necessary to establish more populations.

4.2 **Determine additional actions necessary to achieve recovery.** More research and more refined and stringent management practices may be necessary to protect the species.

#### C. REFERENCES

- Bissett, N. 1988. Personal communication to Bok Tower Gardens Endangered Plant Program, Lake Wales, Florida. The Natives Nursery, Davenport, Florida.
- Chicardi, E. 1991. Personal communication to Bok Tower Gardens Endangered Plant Program, Lake Wales, Florida. 310 Almond Street, Clermont, Florida 34787.
- Judd, W. S. 1980. Status Report on *Warea amplexifolia*. Unpublished report prepared under contract with U. S. Fish & Wildlife Service.
- Myers, R. L. 1990. Scrub and High Pine, pp 150-174 in *Ecosystems of Florida*, in R. L. Myers and J. J. Ewel, eds., University of Central Florida Press, Orlando.
- U.S. Fish and Wildlife Service. April 29, 1987. Endangered and Threatened Wildlife and Plants: Endangered Status for *Warea Amplexifolia* (Wide-leaf Warea). Federal Register 52:82:15501-15505.
- Wallace, S. R. 1990. Central Florida Scrub: Trying to Save the Pieces, pp 59-61 in *Endangered Species Update* 8(1) University of Michigan, Ann Arbor.

### PART III. IMPLEMENTATION SCHEDULE

**Priorities** in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3: All other actions necessary to provide for full recovery of the species.

**Abbreviations** in the Implementation Schedule:

Bok	Bok Tower Gardens Endangered Plant Program
DNR	Florida Department of Natural Resources, Division of Recreation and Parks
FNAI	Florida Natural Areas Inventory
ES	U.S. Fish and Wildlife Service, Ecological Services, Endangered Species
TNC	The Nature Conservancy
Counties	Planning Departments and other agencies in Lake and Polk Counties

# IMPLEMENTATION SCHEDULE

Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
				Fish & Wildlife Region	Division	Other	FY 1	FY 2	FY 3	
Protect existing populations.	1						\$4,000	\$3,000	\$2,500	
Inventory & monitor known populations.	1.1	1	ongoing	4	ES	FNAI, counties				
Seek new populations.	1.2	2	ongoing	4	ES	FNAI, counties				
Alert planning agencies.	1.3	1	1 year	4	ES					
Educate & provide technical assistance.	1.4	1	ongoing	4	ES	FNAI				
Acquire land, obtain protected status & funding for sites.	1.5	1	2 years	4	ES	TNC, counties	\$3,000	\$6,000	\$6,000	Any Fish and Wildlife Service funding of land acquisition will be planned separately.
Research	2									
Determine appropriate management techniques.	2.1	1	3 years	4	ES					
Determine essential attributes of sites.	2.2	2	3 years	4	ES	TNC, Bok, DNR				
Determine effect of rainfall timing and amount.	2.3	2	3 years	4	ES	TNC, Bok, DNR				
Determine normal range of variation in population size.	2.4	2	3 years	4	ES	TNC, Bok, DNR				

# IMPLEMENTATION SCHEDULE

Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
				Fish and Wildlife Region	Division	Other	FY 1	FY 2	FY 3	
Develop methods for establishing new populations .	2.5	2	1-5 yrs.	4	ES	Bok DNR				
Establish new populations.	3						\$3,000	\$4,000	\$3,000	
Locate appropriate recipient sites.	3.1	2	2 years	4	ES	FNAI TNC DNR counties				
Collect seed.	3.2	2	1-5 yrs.	4	ES	Bok, TNC DNR				
Introduce seed.	3.3	2	2 years	4	ES	Bok, TNC, DNR				
Establish monitoring & management program .	3.4	2	ongoing	4	ES	Bok, TNC, DNR				
Establish & monitor new populations .	4	2					\$2,000	\$2,000	\$4,000	
Reassess number of sites & individuals necessary to achieve recovery.	4.1	2	1-5 years	4	ES					
Determine additional actions necessary to achieve recovery.	4.2	2	1-5 years	4	ES					

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